## Technology: Optoelectronics

### Northlight's new facility

Swedish Northlight Optronics, which bought Ericsson's optoelectronics business at the start of this year, plans to move to a new, purpose built facility. The new site is at Järfälla near Stockholm, Sweden, and located in the former ADC pump-laser manufacturing facility. It consists of 1,200m² of clean room space and 1,600m² of office, labs and production space.

### Nichia & Osram x-license

The long running patent dispute between Nichia, Japan and Osram Opto Semiconductor, Germany over rights to blue-emitting GaN/InGaN semiconductors has ended with the two companies signing a patent cross license agreement that covers rights to the semiconductor materials and related packaging technology. The agreement includes white LEDs made by combining GaN/InGaN with a thin layer of phosphor. Market analysts claim the litigation has delayed the growth of the blue LED market and kept the price of the devices artificially high. Several other major producers of GaN/InGaN LEDs such as Cree, Rohm and Toyoda Gosei have also been embroiled in patent disputes.

### OrbitIQ prototype

MetroPhotonics Inc, a developer of monolithic photonic ICs using patented Echelle Grating designs, and Indium Phosphide material, has retained the services of OrbitIQ as their primary sales and marketing channel partner.

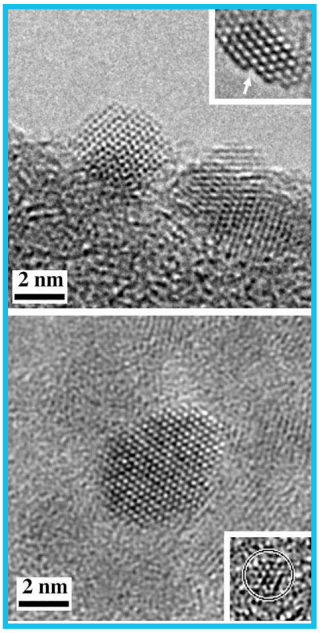
This follows the recent commencement of MetroPhotonics sampling their alpha prototype of the SurePath Monitor to a range of Tier 1 customers.

# Cermet works on ZnO & GaN for Airforce, Navy and DoE

Cermet, which develops and manufactures semiconductor materials and devices based on gallium nitride (GaN), zinc oxide (ZnO), and related compounds has been selected by the Department of Energy to develop UV LEDs. In this it will develop nitride based UV LEDs on Cermet's bulk aluminum nitride at specific emission wavelengths. The DoE is investing in UV LED technology to accelerate the implementation of solid state lighting.

The Navy Department wants Cermet to develop short wavelength ZnO laser emitter diode structures. Commercial applications for these short wavelength lasers include emitters used in optical data storage. Using a laser system with shorter wavelengths in today's DVD systems would quadruple that system's data storage capabilities. By reducing the wavelength of optical emitters, the etch pit size of optical storage disks can be smaller. This in turn leads to a higer density of bits that can be stored on each disk. For this reason, while GaN-based laser systems have amassed popular support, "ZnO has a higer exciton binding energy than GaN, which allows it to have a higher probability of lasing. This along with lower production costs allow the ZnO materials system to be an increasingly emerging alternative to the very expensive nitrides in the wide bandgap technology arena," says Dr Vicente Munne, Cermet's principal research engineer.

Cermet is working on two Air Force developments.
The first is to develop ZnO based spintronic FETs. In this development it will collaborate with Hadis Morkoç of Virginia Commonwealth University to develop novel spintronic FETs on zinc oxide. Spintronics with its inclusion of the spin quality of the electron along with its charge, has many functionalities beyond conventional electronics. Development of diluted magnetic semiconductors (DMS) in select semiconductors will lead to room temperature devices and a better understanding of spin injection, control, and transport. DMS devices increase the capabilities of magnetic sensors, data storage, logic, light emitters, and optical switches by increasing functionalities and sensitivities, and by lowering power consumption.




*TEM image of ZnO particles formed by colloidal synthesis. The top image shows three particles about 37Å in diameter. The particle in the inset shows faceting with a surface step consistent with a single atomic layer. The bottom image shows a single particle. Particles less than about 50Å in diameter exhibit optical properties that are dependent on the size due to quantum confinement.*
**Source:http://www.jhu.edu/~matsci/people/faculty/searson/PCSresearch.html**

Spintronic-based FETs theoretically operate at less power and higher frequencies. In a conventional FET, the gate bias affects the depth of a channel and the amount of current that can be passed. A spintronic gate affects spin quality and transport abilities of individual electrons. Research of the devices is limited by the lack of ferromagneticsemiconductors that can operate at room temperature.

"ZnO and GaN have the best capability of being doped and undertaking ferromagnetic behaviour at room temperature. Cermet's homoepitaxial process and Dr. Morkoç's experience with semiconductor devices create an ideal collaboration to explore spintronic device development," says Ceremet's specialist research engineer, Varatharajan Rengarajan.

In the second project, Cermet's work on ZnO-GaN hybrid spin LEDs is with Dr. Ian Ferguson of Georgia Tech to develop novel spintronic LEDs based on compound semiconductors. The Department of the Air Force is investing in spintronic research for advanced device development. Diluted Magnetic Semiconductors based spin LEDs are appropriate devices for demonstrating room temperature spin transport processes. Dr Ferguson's group at Georgia Tech are actively developing room temperature ferromagnetic materials and devices in ZnO and GaN based materials. "We believe that the strength in material's research at Cermet, combined with those in epitaxial growth and device fabrication at Georgia Tech will ensure the success of this programme," says Ferguson.

## Alphabus emerging

Alcatel and EADS Astrium have agreed on the development and joint marketing of satellites that will use European platform AlphaBus to address the high power satellites market.

A joint team has worked for two years with support from the European Space Agency and Centre National d'Etudes Spatiales to define the new platform designed to carry payloads featuring power in excess of 12 kW.

The first step of the AlphaBus project provides for the possibility to carry loads between 12kW and 18k W with a high growth potential. This will reduce service costs for the user and allow for new multimedia or mobile, new-generation missions.

The two companies decided to pool the best of their know how and experience to develop jointly, qualify and produce AlphaBus to include high-tech equipment from European manufacturers, under the joint prime contractorship of Alcatel Space & EADS Astrium. AlphaBus complements existing Spacebus and Eurostar lines, and is a major European industrial platform for global markets.

## NanoPV on the horizon

California-based Nanosys Inc has signed exclusive agreements for the world-wide rights to a broad set of intellectual properties covering materials and technologies of nanocomposite solar cells, developed by Lawrence Berkeley National Laboratory and Columbia University. Nanosys' co-founder and business development director, Dr. Stephen Empedocles, said that the portfolios cover fundamental and broad-reaching claims protecting some of the most important aspects of solar power generation from inorganic semiconductor nanomaterials and nanocomposites formed from nanocrystals, nanorods and nanowires. Nanosys is already involved in a partnership with Matsushita Electric Works to jointly develop and incorporate nanocomposite solar cells into building materials for residential and commercial facilities in Asia.

The company now plans to release the first of its commercial products based on these new technologies in 2006.

"Currently, our nano composite solar technology is the first nano technology slated for release by Nanosys. This is being done in conjunction with our corporate partners, Matsushita Electric Works," said Empedocles.

## HWG is optical PCB

QinetiQ working with Engent, a Siemens Dematic spin off, is to speed up on the assembly of the novel hollow waveguide optics (HWG) technology it has developed and expects to lead the development, production and commercialisation of high quality, low cost optical circuits and networks based on HWG technology. "The optical hybrid technology we have devised is a significantly simpler way of building up optical circuits … and turns the conventional rib waveguide structure on its head. The method has the potential to cut more than 50% off the cost of complete optical circuits," says James McQuillan, QuinetiQ's telecoms product manager. "In a way it's the optical equivalent of printed circuit boards."

## Umicore buys GE for IR and reports on materials

Umicore has acquired Eagle Picher Technologies' germanium products business in infrared optics and fibre optics applications, for $15m in cash. It has not taken Eagle-Picher's germanium substrates business.

During Umicore's Q1, demand for high purity chemicals saw deliveries of germanium tetrachloride for optical fibres improve slightly compared to the end '02. This does not mean demand upturn from end consumers, but results from a slight demand increase from cable manufacturers who recommenced purchasing after a long period of de-stocking. Deliveries of germanium dioxide were stable.

Optics business has been stable overall but pressure on premiums remains, due to increased levels of competition. There was a slight improvement in the finished laser optics segment. Sales of germanium substrates for solar cells dropped as a result of lower activity in world satellite programmes. Recovery is expected in '04. Progress has been made in development of germanium substrates for other opto/electronic applications.

Lower sales of thin film materials to the optical data storage sector contrasted to improved demand from electronics and optics. Indium activity records low levels of sales in 1Q.

Megapode division reported increased sales volumes of synthetic diamond grit and polycrystaline products compensating for price erosion. It improved process efficiency reducing working capital.

## Technology: Optoelectronics

### Toshiba's D&E Centre

Toshiba has begun work on its new Kitakyushu 7,200m² development and evaluation centre in Kyushu, Japan. The new centre brings together the company's analogue IC and optical device development activities and some 500 engineers. The first floor of the facility is given over to equipment for testing analogue ICs, with development and design on the second and third floor. The new Centre also houses Kitakyushu Operation's optical devices development, including LED lamps.

### Broadband component

Eblana Photonics which specialises in laser components for broadband communications has a high performance uncooled laser diode emitting at 1490nm wavelength for optical fibre based FTTH/FTTP applications. The product EP 1490 completes its broadband oriented product set of 1550nm and 1310nm wavelengths.

### One chip lasers II-VI & III-V

Researchers at Tohoku University have realised a one-chip multiple wavelength laser diode with II-VI and III-V compound semiconductors. The feasibility of the II-VI/III-V complex light emitter was demonstrated using optical pumping experiments. Optically pumped lasing at 504 and 664nm was achieved from II-VI and III-VI laser structures on one chip simultaneously with a threshold power of 115 and 84 kW/cm2 respectively.

*Contact: jssong@imr.tohoku.ac.jp*

### UV beam at 10.4kJ pulse

Scientists at the National Ignition Facility (NIF) have produced record energy from a single UV laser beam. Lawrence Livermore National Lab which hosts NIF, say a UV beamline recently produced a 10.4kJ pulse.

## Bookham still grows by acquisition

Bookham Technology continues it growth by acquisition in its latest purchase of Cierra Photonics.

In September '02 Bookham and Cierra formed a mutual association on functionality for WDM products. In March, Cierra launched Advanced Energetic Deposition III technology, a combination of leading factory automation and advanced robotics, to lower costs and raise yield in thin-film filters and other fibre optic devices.

The acquisition sees Cierra issued with 3m new 'O' shares in Bookham Technology. On a closing price of Bookham 'O' shares on July 3, 2003, the acquisition is valued at some £2.25m. Subject to specific sales over the next two years, a potential further 4.2m 'O' shares in Bookham could be issued to Cierra. "This acquisition, though small in scale, underscores our commitment to expand our position," says Bookham's president and CEO Giorgio Anania.

## Contract for display

Kopin Corp has been awarded a defence contract for production of display systems that will help soldiers 'see' in total darkness, adverse weather, battle field smoke and dust. The contract was awarded because the CyberDisplay 640M microdisplay system met aggressive weight, battery life and reliability targets. Kopin will supply Raytheon Company with microdisplay systems based on the industrial grade Cyber - Display 640M. A rugged active matrix liquid crystal display, it will operate as the IR viewing device on Raytheon's Light Thermal Weapon Sight designed for U.S. Army- and Marine-issued M-16 and M-4 rifles. Technology research firm Maxtech International estimates that the US market for infrared imaging devices will exceed $2bn by 2004.

## US GeSi approach

A system to measure the amount of light delivered by fibre optic cables has been developed by the US National Institute of Standards & Technology, which designed the optical detector. Included is an optical multimeter, designed by ILX Lightwave, that measures light emitted from a fiber over a wide range of wavelengths.

There are two versions of the detector, one using silicon-based sensors, the other using germanium-based sensors. The sensors connect directly to an optical fiber without any additional optics and with barely measurable light loss. Measurement uncertainty is half that of previous optical fiber power detectors.

According to NIST engineer John Lehman, independent measurements of the detector's performance by NIST and its German counterpart, PTB (Physikalisch-Technische Bundesanstalt), are in "excellent agreement." Another comparison will be made this summer with NIST's British counterpart, the National Physical Laboratory. The new systems are now with military calibration centers where they will be used to annually check the accuracy of optical fibre power systems used in the field.

## Adaptive Optics

AOptix Technologies, a laser communication systems provider, has closed an $18m Series B round of financing, co-led by Lehman Brothers and 3i. The round also included participation from existing investors Kleiner Perkins Caufield & Byers and Clearstone Venture Partners. As part of the financing, Brian Paul of Lehman Brothers and David Aslin of 3i have joined AOptix's Board of Directors. AOptix's Lasercom systems are built upon an entirely new and radically different core technology called Adaptive Optics (AO). By combining wavefront sensors, deformable mirrors, extremely narrow light beams and precision beam tracking, AO dynamically corrects signal distortions caused by turbulent air and office windows. In addition, AO makes it possible to create an all-optical Lasercom system without traditional optical-to-electrical conversions.

## Agilent shifts sites

Agilent is to close its Ipswich, UK fiber-optic component fab (cost $20m, completed in 2002) by month end, with a loss of 200 jobs. It retains 50 R&D and marketing staff in a smaller facility. Production of DFB lasers and photo detectors moves to the new $92m facility in Yishun, Singapore, which opened in February and manufactures opto couplers, standard-brightness LEDs, and IR emitters. Agilent has also moved its entire VCSEL component manufacturing to Singapore, leaving Lumileds as its only device manufacturer in the US and its major European site as the Turin 40,000ft$^2$ R&D facility acquired in 2000.

## Technology: Optoelectronics

### US Airforce contract

Sensors Unlimited Inc, working on InGaAs technology, has received a US Air Force contract for the first phase of a 33-month programme to develop a high frame rate, high bandwidth, low noise, focal plane array and camera for active tracking, wave front sensing, laser ranging, imaging, and scoring.

### UV sterilises

American inventor Jon Roberts has developed a sterilising gadget for telephone handsets, aimed at counteracting SARS. The phone's cradle houses two small lamps beaming UV light onto the handset killing viruses and bacteria.

### Chip channels colours

Photonic crystals that form integrated optics chips have regularly spaced gaps that block certain wavelengths of light. Boundaries between material bend light. Adding intentional defects, or areas without gaps, means photonic crystals channel light through very small areas. But it has been difficult to make crystals effectively handle several wavelengths, or colours of light. Now Kyoto University researchers have a miniature prototype add/drop mux that contains seven photonic crystals with proportionally smaller gaps. Devices could appear in 2-5 years, say researchers.

### Swiss wavesplitter

Swiss Federal Institute Technology researchers have designed a photonic crystal mux that splits a lightwave into two slightly different colours. The T-shaped mux has an input and a pair of output channels. Input has no holes, outputs have different size holes. The mux fits in smaller than previous photonic crystal designs and is many times smaller than today's fiber-optic devices.

## Technology: Optoelectronics

### LED intensity & power

Pro-Lite Technology LLP (Milton Keynes, UK) has a range of modular radiometers and photometers designed specifically for the determination of LED luminous and radiant intensity and power. Measurements are made using photodiode detectors with either radiometric filter ('flat response,' 450-950nm) or with a photopic filter precision matched to CIE V (l) response. An integrating sphere probe ensures that all of the highly divergent light from the LED is captured, which minimises positional errors associated with using large area photodiodes to measure LED power. For luminous and radiant intensity measurements, the LED is fixed using a measurement probe with a defined solid angle field of view into the photodiode.

### Thorlabs gets Tektronix GmbH

Thorlabs Inc has acquired Tektronix Munich GmbH, a subsidiary of Tektronix Inc. Formerly Profile Optische Systeme GmbH, Tektronix Munich has a high performance product reputation. PMD analytical instruments, DWDM sources, control modules, and laser diode instrumentation are representative of its portfolio.

### New low power laser

Coherent Inc has a new low-power $CO_2$ laser with excellent beam quality and very small footprint. The GEM-40 OEM laser provides more than 40W of output power at 10.55-10.63µm, with greater than 98% TEM OO spatial mode, and M2 up to 1.2 beam quality. The GEM-40 is ideal for medium/high-volume engraving and desktop manufacture.

# E-lux excimer beam light

TuiLaser of Germany has introduced a compact excimer-lamp that uses an electron beam, rather than a gas discharge, to stimulate light emission. The e-lux is fully tunable from continuous wave (CW) right down to pulses as short as a few nanoseconds. In contrast to other excimer sources, the e-lux is electrode-free and does not rely on a gas discharge. It uses an electron-beam that is separated from the gas by a thin film. The electrons react with the gas over a small area, giving control over the final emitted beam size. Lamps can have an efficiency approaching 40%. The company has two prototypes. The first has an output of 308µ and the second emits at 121µ. The same technique can be used to generate light at the full range of excimer wavelengths including 157, 193 and 248µ. TuiLaser hopes to be selling the product by year-end.

## FDA clearance for Alderm, PhotoTherapeutic & Lumenis

An acne treatment system that uses blue LEDs is to go on sale in the US. Alderm of the US and Photo Therapeutics of the UK have received clearance from the US Food and Drug Admin. to market their system. The Omnilux Blue system will now be available in the US and used for treating a range of skin conditions including moderate inflammatory acne. The instrument contains five arrays of LEDs emitting at 415µ and delivers approximately 40mW/cm² to the surface of the skin. Patients do not have to apply a cream to their skin as the technique simply relies on the interaction of the blue light with the infected skin. Lumenis Inc also has FDA clearance for its Intense Pulsed Light technology products for treatment of hype-pigmentation and redness associated with the skin condition rosacea.

"Our ongoing IPL technology investment continues to set the pace with expanded applications," says executive VP, Alon Maor. Lumenis has annual investments in R&D that far exceed the industry average. It is also one of the most diversified manufacturers with gas-based, solid-state and diode-pumped lasers.

Other applications include VersaPulse PowerSuite holmium and holmium neodymium:YAG (Nd:YAG) laser for surgical treatment of kidney stones and benign prostatic hyperplasia.

# Escaping diffraction

An international team of physicists led by Henri Lezec and Thomas Ebbesen of the Louis Pasteur University in Strasbourg has shown that large amounts of light can pass through a sub-wavelength aperture in a patterned metal film without being diffracted. Lezec and co-workers created a sub-wavelength aperture in a thin silver film and etched a periodic pattern of grooves around it, using a focused ion beam. By patterning the reverse side of the film, they also discovered that the light emerges from the hole as a tightly focused beam that can propagate with very little divergence. The team then found that the direction of the transmitted light could be controlled by changing the symmetry of the periodic pattern. The technique may be useful in a variety of nanoelectronics applications, including optimising near-field devices for micro scopy or data storage, and improving optical devices such as light-emitting diodes (LEDs) and semiconductor lasers.

## Nano nitrides emerging

*Source for micro nano belts, combs, mills and saws*

Korean researchers are working on large scale synthesis of gallium nitride nanosaws using CVD. A large quantity of GaN nanostructures (nanosaws) was produced by a CVD of $Ga/Ga_2O_3/B2O_3$ mixture under $NH_3$ flow. All of them have a single-edged sawlike configuration. The average width of the nanosaw is in the range 100 nm–1m and the thickness is about 1/10 of the average width. They consist of a single-crystalline wurtzite structure with the [0 1 1] direction parallel to the long axis and the [0 0 1] direction perpendicular to the edge of saw teeth. Jagged edges are in an angle of 100°–110°. The room-temperature cathodoluminescence exhibits a strong band-edge emission at 3.46eV. The idea is catching on. At a US surface science symposium in June, a poster prepared by D Moore, *et al* was devoted to 'Nanobelts, nanocombs, nanowindmills and nanosaws of wurtzite ZnS.'